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FARMERS' BULLETIN



WASHINGTON, D. C.

749

AUGUST 12, 1916

Contribution from the Bureau of Plant Industry, Wm. A. Taylor, Chief.

GRAINS FOR THE MONTANA DRY LANDS.

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INTRODUCTION.

During the past 10 years the vacant lands of Montana have been rapidly settled. Much of the land has been homesteaded by people from other States. These settlers as a rule are not acquainted with farming conditions in Montana or with the crops to grow. As a result there is a constant demand for information regarding varieties of grain for the dry farms and how to grow them.

The purpose of this bulletin is to present the best available information regarding the varieties of grain to grow on the dry lands of Montana and the best methods of growing them. This information is based in part on tests conducted for the past eight years at the Judith Basin substation,¹ Moccasin, Mont. The substation is located in the center of the Judith Basin, in Fergus County, and in about the geographical center of the State. The crops that will be discussed are winter wheat, spring wheat, oats, barley, and flax.

THE DRY-LAND SECTIONS OF MONTANA.

In general the dry-land farming sections of Montana lie in the eastern two-thirds of the State. The western portion is mountainous,

¹The cereal experiments at this substation are conducted cooperatively by the State Agricultural Experiment Station of Montana and the Office of Cereal Investigations of the Bureau of Plant Industry. Persons interested should write to the Director of the Agricultural Experiment Station, Bozeman, Mont., for other publications on crops for Montana.

and comparatively little of the land is suitable for farming. The accompanying map (fig. 1) shows the location of the Judith Basin substation (Moccasin) and also gives the rainfall at a number of points in Montana.

TOPOGRAPHY.

In general the dry lands of Montana are of two main types, the bench lands and the rolling hills. The bench lands are usually fairly level plains that lie above the river and creek bottoms and can not be irrigated. These lands may be broken to some extent by small creeks and coulees.

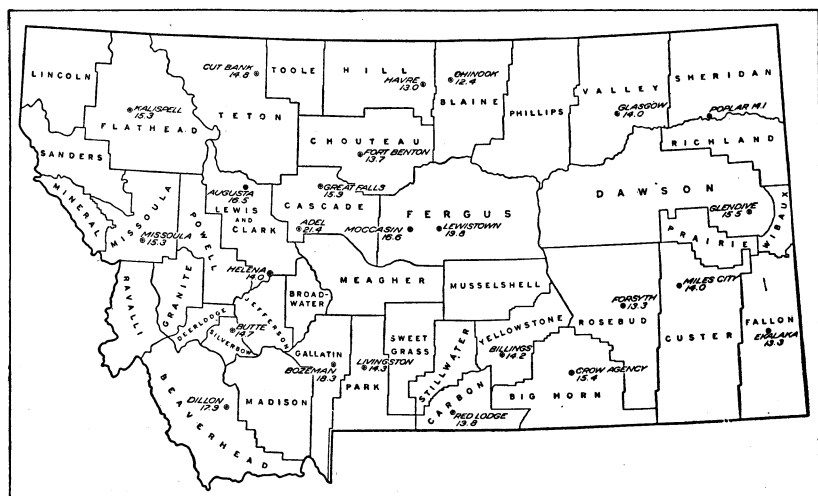


FIG. 1.—Map of Montana, showing the location of the Judith Basin substation (Moccasin) and of other points in the State. The figures indicate the average annual rainfall in inches. These averages for the most part are for 16 years (1898 to 1913).

The other type is characterized by gently rolling hills with small valleys between. Here the farming is usually done on the gentle slopes and in the valleys. This type of land is quite common in the extreme eastern part of the State, but is also found throughout all the dry-land districts.

SOIL.

The dry lands of Montana are mostly clay loam. They vary, however, from a heavy gumbo to a light sandy soil. The extremes of gumbo and light sand are not common. In the Judith Basin the general type is a rather heavy clay loam. Taken as a whole, the soils of the dry-land sections are well supplied with plant food. The depth of the soil varies in the different localities, although in most sections it is fairly deep.

CLIMATE.

There is considerable variation in the climatic conditions affecting crop growth in the different sections of Montana. In general, the extreme eastern part of the State has less rainfall, hotter summers, and a longer growing season than the central and western portions. Toward the western part of the State the rainfall gradually increases and the growing season is shorter.

RAINFALL.

Of all the physical factors that influence and control the growing of crops on the arid lands of Montana the rainfall and its distribution are the most important. About one-half the annual rainfall in Montana comes in April, May, June, and July, the months when it is of most benefit to the growing crops. This seasonal distribution is fully as important as the amount of the total rainfall.

The total annual rainfall varies from 13 inches at Glasgow in Dawson County to 21 inches at Adel in Cascade County. The average annual rainfall at Moccasin for the last 18 years was 16.6 inches. This is about the average for the Judith Basin but is a little higher than the rainfall in those sections of the dry-land area that lie east and north of the Judith Basin.

EVAPORATION.

Evaporation is another important physical factor that influences crop growth. It is in a way the measure of the usefulness of the rainfall. A section with a high rainfall and high evaporation may not grow any better crops than a section with less rainfall but low evaporation. The evaporation in Montana is lower than in the central and southern portions of the Great Plains. As a result it is possible to grow crops in Montana with less rainfall than in other sections where the evaporation is higher.

TEMPERATURE.

The temperatures in the various dry-land sections of Montana are variable. As a rule the summer temperatures are higher and there is more wind in the eastern part of the State than in the central and western portions. This is probably because the altitude is lower in the east and that section is farther removed from the influence of the mountains. Toward the mountains there is less variation in temperature but a shorter growing season. At Moccasin the average frost-free period is 116 days. This is about the average length of the growing season in the Judith Basin and other dry-land sections west of it at about the same altitude. To the north

and east of the Judith Basin, where the altitude is lower, the frost-free period is longer.

DRY FARMING IN MONTANA.

It is only within the last 10 or 12 years that dry farming has been practiced in Montana. Previous to that time nearly all the crops grown were produced under irrigation, and the dry lands of the State were used for the pasturing of cattle and sheep. As more settlers began coming in, it was found that lands which were considered worthless for anything but pasture would produce good crops. With the opening of large areas to homestead entry the increase of dry farming was very rapid. At the present time much of the available land in Montana has been taken up and is rapidly being brought under cultivation.

CROPS GROWN.

Many new settlers in the State had very little capital with which to start. In many cases they were a long distance from market. It was natural, therefore, that they should grow a crop for which there was a ready cash market. The grain crops filled the bill. There is always a ready market for grains, especially wheat and flax. Their value is high in proportion to their bulk.

The average dry farmer when first starting has very few live stock. Crops are grown for market and not for feeding. As a result wheat and flax were the most important and in many cases the only crops grown. As the number of stock on farms increases, the production of feeding crops, such as oats and barley, also increases. No matter what system of farming is practiced, the cereal crops will always be important on the dry-land farms of Montana.

GROWING THE GRAIN CROPS.

The directions for growing cereals here given are general. Because of the variations in the soil and climatic conditions of the sections discussed, these directions may not apply in detail to all localities.

PREPARATION OF THE SEED BED ON SOD.

The best time to break the native sod is in April, May, and June. The work can be done most easily then because of the moist condition of the ground. A good job of breaking is shown in figure 2. If the grass is thick and the sod is tough, break $3\frac{1}{2}$ to 4 inches deep; if the grass is thin and the sod is light, 6-inch to 7-inch plowing may be done. Follow the plow with either a roller or a disk to pack the sod and bring it in contact with the lower soil. This should be

done the same day that the sod is turned. If the packing is done with a roller, which is the best method, follow with a disk harrow or a spike-tooth harrow to form a loose mulch on top.

If a spring crop is to be grown, sod land should be plowed early to allow early seeding. If winter wheat is to be grown, the plowing need not be so early, but the preparation should be the same in either case. In some sections it is the practice to plow the sod shallow and then backset, plowing 7 or 8 inches deep. This makes a good seed bed, but on account of the extra expense it is hardly to be recommended unless the farmer has plenty of horses and time.



FIG. 2.—Sod land in the Judith Basin broken with the moldboard plow. The plow should have been followed with a heavy roller to flatten the furrow slice and bring it in contact with the moist subsoil.

PREPARATION OF THE SEED BED ON STUBBLE OR OLD LAND.

No definite rule can be laid down for the best time of plowing old land. This will depend upon the locality, the condition of the soil, and the other farm work. In the eastern part of the State, where the seasons are longer, it will often be possible to plow in the fall. Farther west there is seldom time after harvest to do much fall plowing. Plow when the land is in good condition and other farm work will permit. Plow 4 to 8 inches deep. Do a good, clean job, turning under all weeds, trash, and stubble. If the land is plowed in the spring, follow the plow with the disk and spike-tooth harrows. If in the fall, the ground may be left rough, to prevent

blowing and to catch snow. The disk and spike-tooth harrows should then be used in preparing a seed bed the following spring.

A good seed bed should be firm underneath, with 2 or 3 inches of loose soil on top. This condition may be obtained by using the disk and spike-tooth harrows. Where spring grains are to be seeded on spring plowing, this work should be done immediately after the land is plowed. If the spring plowing is intended for winter grains, leave the surface of the soil rough until weeds and volunteer grains start. Then cultivate with disk and spike-tooth harrows. This will destroy the weeds and put the land in good tilth for fall seeding.

SUMMER FALLOW.

The practice of letting the ground lie idle through the summer every other year and keeping it free from weeds by clean cultivation is followed in most dry-land regions. The purpose of this summer fallow is to collect and conserve moisture for the crop that is to follow. This is an expensive practice. The land is plowed and cultivated, but no return is received from it that year. Summer fallowing can not be recommended as a general practice for the dry lands of Montana. Where winter wheat is to be grown on a large acreage it may be necessary to use this method to some extent. Where fallowing seems necessary it is more profitable to fallow every third year than every second year.

Land that is to be summer fallowed should not be plowed until weeds and volunteer grain have started growth. This will usually be in May and June. Turn under all the weeds, stubble, and trash. After plowing, do not cultivate enough to pulverize the soil. A rough mulch is better than a dust mulch. It will not blow or puddle. Keep the weeds down. The purpose of the fallow is to conserve moisture. Weeds use more moisture than is lost through evaporation. Cultivate when the weeds are small. Use a weeder that will not fine the soil too much.

The use of an intertilled crop, such as corn, is a profitable substitute for fallow. Corn is a profitable crop in a rotation for the average dry-land farmer of Montana. In most of the dry-land sections it will produce a good yield of grain, and it will always yield from 2 to 4 tons of fodder per acre. If the corn crop is cultivated and the weeds kept down, a good seed bed for small grain can be prepared by disking the corn stubble. Spring grains adapt themselves more readily to this method than winter grains. Where spring grains are to be sown, do not disk the corn land until spring, as the stubble will help to hold the snow. There is very little difference in the yields obtained from grains grown on fallow ground and grains sown on disked corn stubble. The latter method has the advantage

of producing a profitable crop each year with but little more work than is necessary in the fallow system.

SELECTION OF SEED.

It pays to use good seed. Grow varieties that are adapted to your locality and conditions. Make sure that the seed is free from all weed seeds and from disease. This is important. Clean the seed well, blowing out all small and immature kernels and all trash. Every farmer should grow his own seed. He then knows what he is sowing and what results he can expect. By selecting seed from fields that are free from weeds and disease and that produce grain of the best quality, he can maintain and improve the quality of the grain he is sowing.

TREATING SEED FOR DISEASE.

Smut is probably the most common of the grain diseases in Montana. It is more often found in wheat than in any of the other grains. Smut can be fairly well controlled by treating the seed. The formaldehyde treatment is most commonly used for the stinking smut of wheat, oat smut, and the covered smut of barley. Mix 1 pound of 40 per cent formaldehyde (the ordinary commercial article, which can be purchased at almost any drug store) with 45 gallons of water. Place the grain in a pile several inches thick on a clean floor or canvas. Sprinkle the grain with the solution until every kernel is thoroughly wet. Cover this grain with sacks or a blanket for several hours. Then spread it out until it is dry.

The grain may also be treated in sacks. Place the solution in a barrel. Put a bushel to a bushel and a half of grain in each sack. Tie the sacks at the top, leaving plenty of room for the grain to swell. Soak the grain for 10 minutes in the solution. If the sacks are not too full, the grain will dry out in the sacks if they are set where the wind strikes them. Do not allow the grain to freeze while it is wet.

In treating grain, care should be taken to have the solution the right strength. If too weak it will not kill the spores. If too strong it will injure the grain. Be sure the formaldehyde you buy is full strength.

Wash out the drill with the formaldehyde solution. This will destroy any smut spores that may be in the drill.

For a more complete discussion of the smuts of grain and of smut treatments, see Farmers' Bulletin 507.

HARVESTING THE GRAIN CROP.

There are three general methods of harvesting the grain crops in Montana: (1) With combines, (2) with headers, and (3) with binders.

The use of combines (combined harvesters and thrashers) can not be recommended in Montana. When they are used the grain must be left standing until it is overripe. The weather in the autumn is likely to be unsettled. Rain and snow often fall before the grain can be cut. The quality of the grain that is left standing waiting for a combine is lowered by these storms. The grain is also likely to lodge, and part of it is then lost.

On the larger farms where most of the land is cropped to grain, cutting with a header (fig. 3) is the most practicable method. Fields cut with the header must be left until just about ripe. Grain can not be safely cut as green with the header as with the binder, but it can be cut greener than with the combine. Cutting grain with a header has the following advantages: The crop is removed from

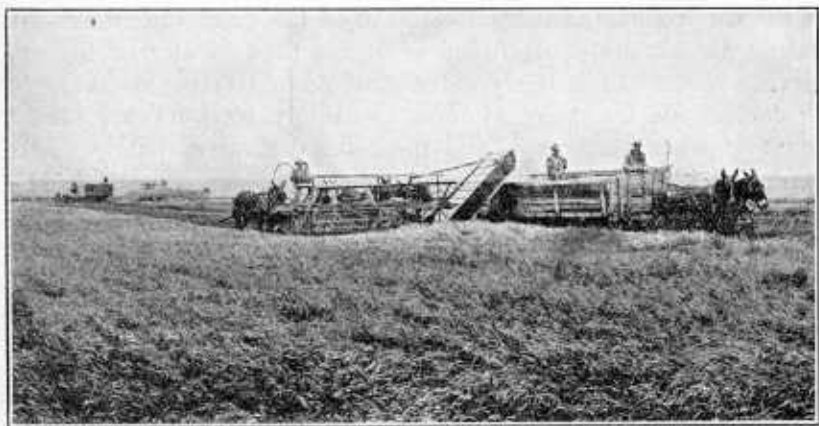


FIG. 3.—Harvesting wheat with a header. The headed wheat is being stacked in the center of the field to avoid long hauls with the header racks.

the land sooner than when it is bound and shoeked, thus allowing more time to prepare the land for the next crop. In a dry year, when the straw is short, the grain can be cut easier and with less loss than with a binder. It makes possible earlier seeding on stubble land. More organic matter in the form of straw is returned to the soil. The expense of stacking headed grain is not so great as that of stacking bound grain. The quality of the grain is not injured by rain and snow, as may happen with standing grain awaiting the combine or grain in the shock. Thrashing can be done after the rush of the other farm work is over. The cost of thrashing is reduced.

Grain cut with a header should be well stacked. Build a good, solid stack that will not blow over. Build it carefully with a smooth, rounded top and sides, so that it will turn rain and snow. On large fields it may pay to use a fork and derrick to do the stacking. The

stacks should be so located as to avoid long hauls. Well-built stacks of headed grain are shown in figure 4.

If the grain is somewhat green or there are green spots in the field, arrange for circulation of air in the stack as follows: Make a platform 6 inches or a foot above the ground by placing small poles or boards across a couple of logs or timbers. Build the stack on this platform. A grain sack filled with hay or straw can be used to make an air hole from the bottom to the top of the stack. Place the sack in the center of the stack at the bottom. Build around the sack, pulling it up as the stack is built and keeping most of the sack above the level of the headed grain. When the stack is finished, pull out the sack and there will be an air space from the top to the bottom. This can be done at several places along the length of the stack. Grain



FIG. 4.—Well-built stacks of headed wheat,

stacked in this manner is less likely to heat or spoil even though it is somewhat green, for circulation of air through the stack is provided.

For the smaller farms, where only part of the land is in grain, the binder is recommended. The binder does not cost as much as the header, nor does it require as many horses or men to operate it. For these reasons it is better adapted to the smaller farms, where the acreage of grain is comparatively small.

On the average-sized dry farm in Montana where diversified farming is practiced it will pay to stack the grain after it is cut with the binder. Where the farmer stacks his grain he is able to get on the land earlier and prepare it for the next crop. It is then possible to sow the following crop early, either in the fall or the spring. Early seeding is important for the successful growing of grain.

If the grain is stacked, it is not necessary to wait for a thrashing machine to come before working stubble land. Thrashing from the shock, as shown in figure 5, delays other work on the land. Grain that is stacked properly is not injured by rain and snow, like shocked grain. Stacked grain costs less to thrash than shocked grain. A smaller crew of men and teams is required. The total cost of stacking and thrashing may be more than the cost of thrashing from the shock, but all things considered it pays to stack. Grain thrashed from the stack sometimes commands a better price.

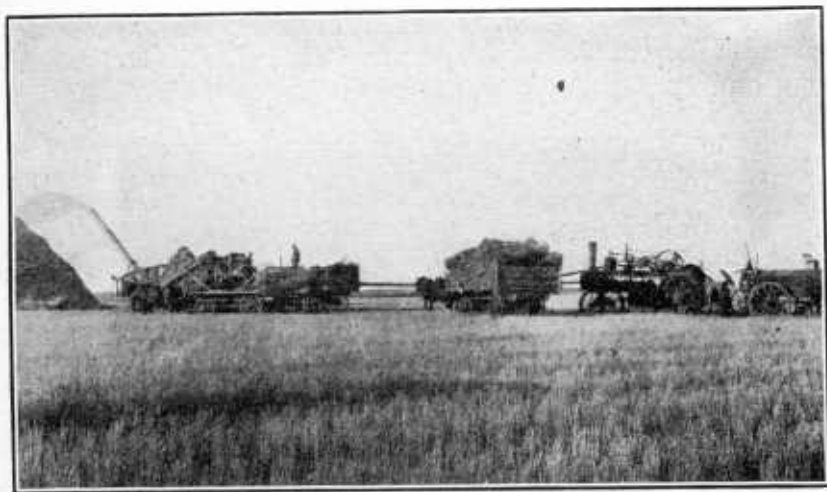


FIG. 5.—Thrashing wheat from the shock. Where wheat is thrashed in this way it is necessary to wait until a thrashing machine is available before the land can be prepared for the next crop.

GRAIN CROPS AND VARIETIES.

WHEAT.

Wheat is the most important dry-land grain crop in Montana. The climate and soil are favorable for the production of this crop, and there is always a ready market for it. It is primarily a cash crop, and for this reason will always be important on the dry farms of the State. The estimated total production of winter and spring wheat in Montana in 1915 was nearly 34,000,000 bushels. An excellent field of winter wheat in the Judith Basin is shown in figure 6.

WINTER WHEAT.

In 1915 the estimated production of winter wheat exceeded that of spring wheat by about 2,500,000 bushels. Winter wheat is not adapted to all of the dry lands of the State. In eastern Montana it is likely to winterkill. Good crops of winter wheat can be raised as

far east as Forsyth, in Rosebud County. East of Forsyth it can hardly be recommended as a safe crop to grow, although it has been raised as far east as Glendive, in Dawson County. If winter wheat is to be grown this far east it should be sown in corn stubble. The cornstalks will help hold the snow and protect the wheat.

In 1915 the estimated production of winter wheat in Montana was 18,225,000 bushels. This was 7,162,000 bushels more than in 1914. This increased production is due largely to the increased acreage under cultivation, resulting from the high prices obtained for wheat in 1914.

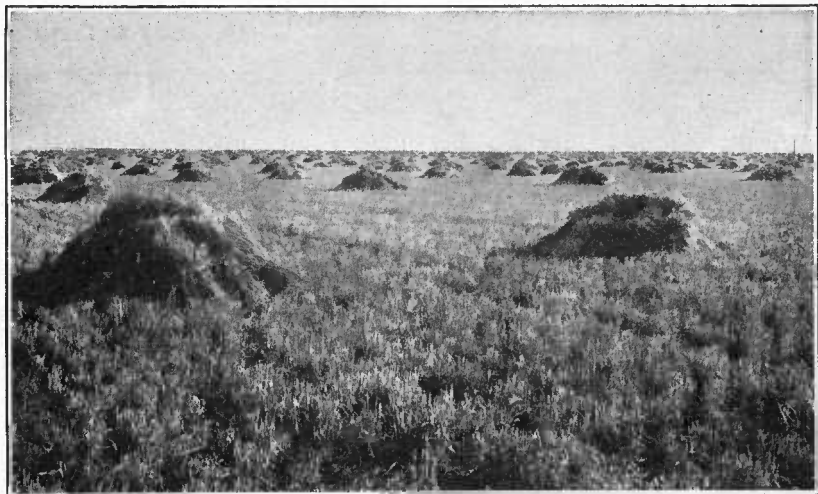


FIG. 6.—Winter wheat on breaking in the Judith Basin. This land was plowed in May and June and the wheat sown the following August. The average yield of the 112-acre field here shown was 35 bushels per acre.

VARIETIES TO GROW.

The winter-wheat variety most commonly grown is the Turkey. This wheat belongs to what is known as the Crimean group of hard red winter wheats. It was brought to this country by the Mennonites in 1873 from the Crimea, in southern Russia. Introductions of the Turkey and other related varieties have also been made by the United States Department of Agriculture at various times.

Experiments with varieties of winter wheat have been conducted since 1908 at the Judith Basin substation at Moccasin. A view of the field plats used in this test in 1915 is shown in figure 7. Of the winter wheats tested at Moccasin for seven years the Kharkof has given the highest yields. This variety belongs to the same group of wheats as the Turkey, from which it can not be distinguished. The Kharkof is a bearded wheat, with hard red kernels, which was im-

ported by the United States Department of Agriculture in 1900 from Kharkof, Russia. It sells on the market for the same price as Turkey wheat and is equally valuable for milling purposes. It will stand more extreme heat and cold than the Turkey and is more drought resistant. Where it has been tried in Montana it has given higher yields than the Turkey. The Kharkof is recommended as the best winter wheat to grow on the dry lands of the State.

DATE AND RATE OF SEEDING.

It is important to seed winter wheat at the right time. The best time to sow varies somewhat in the different sections of the State. In the eastern part it will not be necessary to seed as early as farther

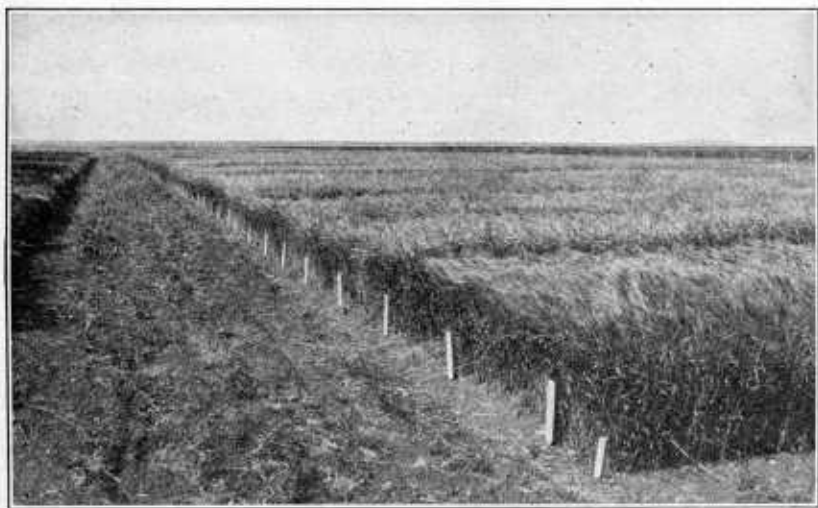


FIG. 7.—Field plats of winter wheat at the Judith Basin substation, Moccasin, Mont., in 1915.

west, where the seasons are shorter. Wheat should be sown early enough in the fall to get a good start before winter. Wheat that is seeded late is likely to winterkill. It is also later in maturing than early-sown wheat. Wheat that is seeded early often matures early enough to escape dry spells that injure late-sown wheat.

The condition of the seed bed influences the time of seeding. There is no reason for late seeding on fallow ground, for it should always contain enough moisture to cause germination. On land from which a crop has recently been harvested there often is not enough moisture in the early fall to start the wheat. In this case it is better to wait until rain comes before seeding. After the crop is removed it is sometimes too dry to plow until after rains come. This will, of course, delay seeding.

In a six-year test at Moccasin the best results have been obtained by seeding winter wheat between August 10 and September 10. The exact date will vary for different years and for different localities. Seeding after the middle of September is risky. While in many cases the wheat will come through, the chances are just as good that it will winterkill. On the average, higher yields are obtained from the early seeding.

On a good seed bed, one that is firm underneath with 1 or 2 inches of loose soil on top, it is not necessary to seed more than 2 or 3 inches deep. The principal thing is to get the seed down to moist earth.

The best rate of seeding for winter wheat on dry land is 3 pecks per acre. This has been proved by experiments conducted at Moccasin and other points in the State. This is the rate used by most of the farmers in Montana. Since winter wheat tillers freely a good stand can be obtained with a light rate of seeding. Some farmers claim that 2 pecks is enough to seed. This may give good results in some years when the wheat is seeded early, but usually it will not give a thick enough stand. Thin stands allow the weeds to get a start and the yield is reduced. When wheat is seeded late it is best to sow 4 pecks per acre. Then if there is some winter-killing the stand will still be thick enough.

Every farmer should test his drill and know just how much it sows when set at a certain rate. A drill often becomes worn and seeds more or less than the indicator shows. If wheat that has been treated for smut is sown before it is thoroughly dry the drill should be tested with the swollen kernels and set to sow at the correct rate.

SPRING WHEAT.

Spring wheat is not as important a crop as winter wheat for the dry lands of Montana. It is most largely grown in the eastern sections of the State where winter wheat is not a sure crop. Spring wheat is more likely than winter wheat to be injured by dry weather and by frost. Experiments at Moccasin show that, on the average, the best winter wheat variety yields about 8 bushels more than the best spring wheat.

Because of its shorter growing season, spring wheat adapts itself more readily to a rotation system than winter wheat. It works in well where a cultivated crop like corn is grown as a substitute for fallow. Spring wheat on disked corn ground is one of the most profitable grain crops that can be grown on the dry lands of the State.

VARIETIES TO GROW.¹

There are two main divisions of the hard spring wheats, the common and the durum (macaroni). These are quite distinct from each other. The durum varieties have broad heads with long, stiff beards. The common wheats have longer, rather slender heads, which may be either bearded or beardless. When bearded, the beards are not so long as those of the durum varieties. Heads of representative varieties of several groups of spring wheat are shown in figure 8.

At Moccasin in a seven-year test the durum wheats have yielded slightly more than the common wheats. Of 12 durum varieties which were tested the Pelissier has given the highest average yield. This variety has not yet been distributed to any great extent. It has hair-

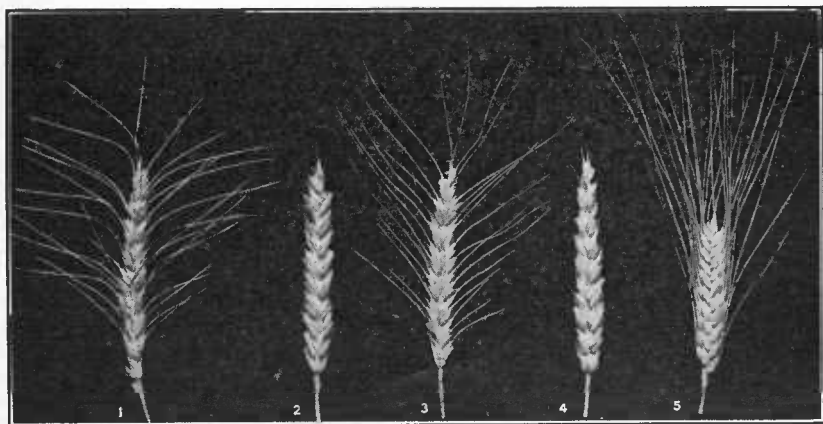


FIG. 8.—Representative heads of different types of wheat: 1, Turkey winter; 2, Fife; 3, Preston; 4, Bluestem; 5, durum.

less white chaff with black beards. The kernels are a little larger than those of most durum wheats and are a clear amber color. Other better known durum varieties that have yielded well are the Kubanka and Arnautka. These varieties have hairless yellow chaff and yellowish beards. The kernels are not quite as large as those of the Pelissier.

Durum wheats are thought to be especially well adapted to the eastern portion of the State. Here the drought conditions are usually a little more severe than farther west. Good yields can be expected from durum wheats on all the dry lands of the State. While durum wheat often does not bring quite as much on the market as spring common wheat, the difference in price in the last few years has not

¹ For a more complete discussion of spring wheat varieties, see Ball, Carleton R., and Clark, J. Allen, "Varieties of hard spring wheat," U. S. Dept. Agr., Farmers' Bulletin 680, 1915.

been very great. Durum has sometimes sold for more than common wheat. The fear of a lower price for durum wheat should not stop the farmer from growing it, as the increase in yield usually will make up for any difference in price.

At Moccasin the yields of the spring common wheats as a whole have not been as high as those of the durums. Some good varieties, however, have yielded as high or higher than the durum varieties. Among these the Marquis is probably the most promising for the dry lands of Montana. This variety has been tested at Moccasin for only three years, but during that time it has yielded about the same as the Pelissier.

The Marquis is a hybrid wheat developed by the Canadian Department of Agriculture. It is beardless, with hairless white chaff. The kernels are short, plump, hard, and usually dark red in color. These characters place it in the Fife group of wheat. It is a good milling wheat and brings a good price. The yields obtained from the Marquis at Moccasin indicate that it is a good wheat for the dry lands of Montana. It is probable that it will be found better adapted to the western sections of the dry-land area. In the extreme eastern part of the State the durum varieties are recommended as being the best varieties to grow.

DATE AND RATE OF SEEDING.

No exact date can be given as the best time to sow spring wheat. This will vary in different years and in different localities. The important point to have in mind is that early seeding is best. Spring wheat should be sown as soon as soil and climatic conditions permit. Since fully half the annual rainfall comes in April, May, June, and July, it is important to have the wheat seeded early, so as to make the best use of this rainfall. Where spring wheat is seeded on corn stubble or fall plowing, early seeding is possible. If the land is weedy it is a good plan to let the weeds start and then cultivate to kill them before seeding the wheat.

At Moccasin the best results have been obtained by sowing the spring wheats at the rate of 4 pecks per acre. This is the rate used by most farmers and is 1 peck more than the usual rate for winter wheat. Where good seed is used, this rate will give a good stand. If the germination of the seed is poor it should be sown at a higher rate. Some of the larger seeded durum varieties should be sown at the rate of 5 pecks per acre.

In the spring there is usually plenty of moisture in the seed bed, so that it is not necessary to sow the seed more than 1 or 2 inches deep. Unless the surface of the seed bed is very dry do not seed deeper than this.

OATS.

The yields obtained from oats at Moccasin have been quite satisfactory. These results and the experience of farmers show that good yields of oats ordinarily can be obtained on the dry lands of Montana. At the present time the dry-land farmer does not grow oats as a cash crop but for feeding. As the stock on the farm is increased, oats will become a more important crop.

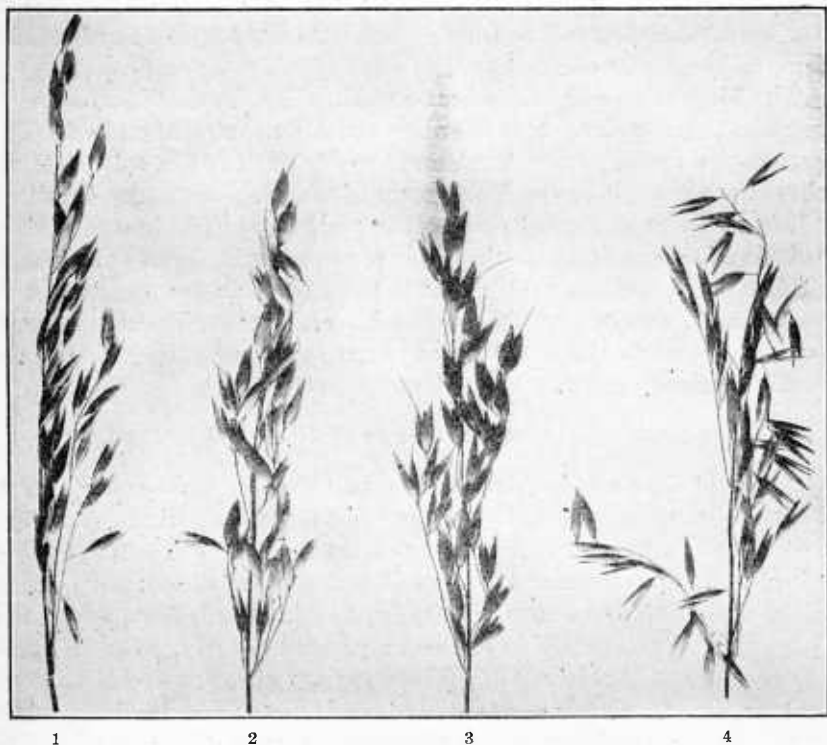


FIG. 9.—Representative heads of different types of oats: 1, White Russian; 2, Siberian; 3, Swedish Select; 4, Sixty-Day.

VARIETIES TO GROW.

The early varieties, such as the Sixty-Day and Kherson, are the best ones to grow. In a seven-year test at Moccasin the early varieties have exceeded the later ones, such as the Swedish Select, by about 16 bushels to the acre in average yield. Heads of the Swedish Select, Sixty-Day, and two other varieties are shown in figure 9. At Moccasin the Sixty-Day variety will mature in about 100 days from the time of sowing. This period will, of course, vary in different seasons and different localities. The Swedish Select and similar varieties are from 10 to 12 days later in maturing.

The Sixty-Day oat¹ was introduced from southwestern Russia into the United States by the United States Department of Agriculture in 1901. The Kherson is a very similar variety, also from Russia. At Moccasin it has not yielded quite as heavily as the Sixty-Day. The straw of these varieties is rather short and fine and the heads loose and spreading. The kernel is yellow in color, small, long, and rather slender. The hull is thin and under favorable conditions the weight per bushel is high. Objection to the Sixty-Day oats is sometimes made because of the small size and yellow color of the kernels. Since oats are grown for feed rather than for market, the yellow color is not objectionable. Tests have shown that the Sixty-Day has a smaller proportion of hull than most of the varieties with larger kernels. Thus a bushel of Sixty-Day oats has a higher feeding value than a bushel of large, thick-hulled oats.

The Sixty-Day variety, because of its fine straw, is better adapted to use for hay than some of the later varieties with coarse straw.

Wherever the Sixty-Day oat has been tried on the dry lands of the State it has given good results. It is recommended as being the best variety to grow on Montana dry farms.

DATE AND RATE OF SEEDING.

As with spring wheat, the best results are obtained from seeding oats early. While they do not require as long a growing period as spring wheat they should be seeded fully as early. Sow as soon as soil and climatic conditions permit. Have the seed bed well prepared. Do not sow the seed too deep; 1 to 2 inches should be deep enough to put the seed in moist soil.

Because of the small size of the grain, a lower rate of seeding is desirable for the Sixty-Day than for most varieties of oats. The best results have been obtained by seeding 4 to 5 pecks per acre.

BARLEY.

At the present time barley is not an important crop on the dry lands of Montana. Its chief value to the dry-land farmer is for feed. The best varieties of barley have produced very heavy yields at Moccasin, and it is believed that the crop should be much more extensively grown. In pounds of grain per acre barley has yielded more than any other grain under experiment.

There are two main groups of barley, the hulled and the naked, or hull-less. In both of these groups there are 2-rowed and 6-rowed and also bearded and beardless varieties. The hulled barleys are used for brewing and feeding purposes, while the hull-less varieties are

¹ For a more complete discussion of this variety, see Warburton, C. W., "Sixty-Day and Kherson oats," U. S. Dept. Agr., Farmers' Bulletin 395. 1910.

used only for feeding. Heads of several of the important varieties of barley are shown in figure 10.

VARIETIES TO GROW.

At Moccasin the highest yielding variety of barley has been the White Smyrna. This is a 2-rowed, bearded, hulled variety. It was obtained from Asia Minor by the United States Department of Agriculture. The head is of medium length and the kernels are large. The straw is rather short, especially in a dry season. The



FIG. 10.—Representative heads of different types of barley; White Smyrna (1) and Hannchen (2), 2-rowed hulled varieties; Coast (3) and Mariout (4), 6-rowed hulled varieties; Nepal (5) and Himalaya (6), 6-rowed naked varieties.

shortness of the straw is the main objection to the variety, but if sown early it will always grow tall enough to be cut with a binder.

The White Smyrna is the earliest of the barleys that have been grown at Moccasin. It matures about the same time as Sixty-Day oats. The length of its growing season varies from 95 to 105 days, depending upon the season and locality. In trials in other parts of the State excellent results have been obtained. The White Smyrna is recommended as being the best barley to grow under dry conditions in Montana. It seems especially adapted to regions where severe droughts are likely to occur.

At the present time the naked variety Nepal is probably the most commonly grown barley in Montana. This variety perhaps is better known as "White Hull-less" and is often called "goose wheat." It is a 6-rowed, hull-less, beardless variety. It has rather coarse straw and broad leaves. The heads have a tendency to break off when ripe and it is likely to lodge in a wet year. It is a little later in maturing than the White Smyrna and does not yield as well. Because of its coarse straw and broad leaves and the freedom from beards it is a very good variety to grow for hay. It is also a good grain to grow for hogging off. To farmers who want a grain for these purposes the Nepal (White Hull-less) barley is recommended.

DATE AND RATE OF SEEDING.

As with the other spring grains, early seeding is necessary to obtain good results with barley. The exact time to sow will, of course, depend upon local conditions. Where the seed bed is well prepared and free from weeds, sow as early as possible in the spring. If the seed bed is in poor tilth or weeds are plentiful it will pay to work the soil to make a smooth seed bed and destroy the weeds, even if seeding is somewhat delayed.

The best results are obtained from seeding the hulled varieties of barley at the rate of 5 pecks per acre and the naked or hull-less varieties at the rate of 4 pecks. The hulled varieties should be sown from the barley side of the drill and the naked varieties from the wheat side.

FLAX.¹

Flax has been grown in Montana chiefly as a sod crop. Because of its high bushel value it is an important crop for the new settler who is a long distance from the railroad. Flax diseases increase in the soil when this crop is grown for several years on the same land; hence, it should be grown in rotation with other crops.

Flax yields at Moccasin have been satisfactory and show that a profitable yield can be produced on the dry lands of Montana. A view of the field plats used for the flax experiments at Moccasin in 1915 is shown in figure 11.

VARIETIES TO GROW.

The best yields in a 5-year test were produced by a variety known as the Russian. This variety belongs to the European seed-flax group. It is grown in North Dakota and has been distributed by the agricultural experiment station in that State as North Dakota No. 155. This Russian flax has yielded better at Moccasin than the wilt-resistant varieties distributed by the North Dakota station. In the

¹ For a more complete discussion of flax growing, see Circulars 22 and 40 of the Montana Agricultural College Experiment Station.

eastern part of the State, where flax diseases are more common, the disease-resistant varieties may do better than the Russian. The Russian is recommended for the western portion of the dry-land sections.

One of the great objections to flax is that it is likely to bring weeds with it. Because of the size and shape of the seed it is difficult to take out the weed seeds. As a result many weed seeds are often sown with the flax. The crop grows slowly early in the season and makes little shade, so that it is a poor weed fighter. For these reasons care should be used in selecting flax seed to make sure that it is free from all weed seeds. Bright, plump, clean seed is

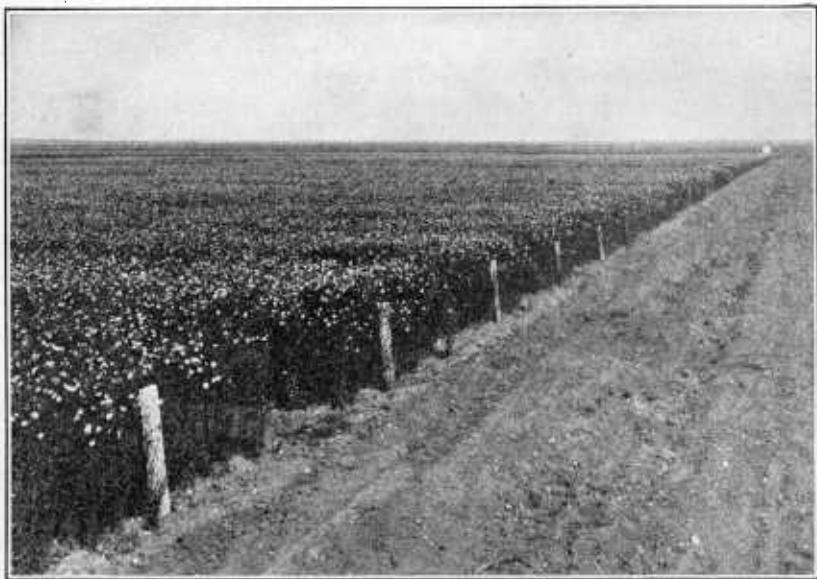


FIG. 11.—Field plats of varieties of flax at the Judith Basin substation, Moccasin, Mont., in 1915.

also more likely to be free from disease than poor, shrunken seed. If clean seed is sown on clean ground, flax that is free from weeds and disease may be grown.

DATE AND RATE OF SEEDING.

The impression is rather general that flax should not be sown as early as the other spring grains. Experiments at Moccasin do not support this idea. In 1915 flax seeded at the same time as oats, wheat, and barley gave a higher yield than flax sown at a later date. While it is probably true that flax can not stand as much frost as the other spring grains, yet the best results at Moccasin

have been obtained from flax sown between April 15 and May 1. Flax seeded after the latter date does not do as well. It is better to risk injury from frost in the spring than in the fall.

On a well-prepared seed bed 20 pounds of seed to the acre is enough. In the eastern part of the State even less seed may be desirable. Flax should not be sown too thinly, however, as too much space is left for weeds.

Flax requires a firm, even seed bed. It is important to have the surface of the seed bed smooth, so as to insure even germination and growth. Flax straw is short, and unless the seed bed is smooth and the growth even some of the crop is likely to be lost when it is harvested.

Do not sow flax too deep. The seeds are small and the young plant has difficulty in reaching the surface. Covering the seed to a depth of 1 or 1½ inches is sufficient.

SUMMARY.

The chief dry-farming districts of Montana are in the eastern two-thirds of the State.

There are two main types of dry-farmed land, the level benches and the rolling hills.

The soils vary from a heavy gumbo to a light, sandy loam. The great bulk of the soil is made up of various kinds of clay loams. All types are usually well supplied with plant food.

The rainfall varies from 13 inches in Dawson County to 21 inches in Cascade County.

Evaporation in Montana is lower than in the southern and central Great Plains area.

The frost-free period at Moccasin, in the central part of the State, is 116 days. It varies from 80 days in the western portion of the dry-farming district to 125 in the eastern.

The small grains are important for the dry-land settler, as there is always a ready market for them.

Native sod should be broken in April, May, or June, and the plow followed with some tool to pack the soil.

The time of plowing old land depends on the soil and climatic conditions and the need for doing other farm work.

Fall-plowed land should be left rough, to catch the snow and prevent the soil from blowing. Spring-plowed land for spring grains should be worked down immediately after plowing.

Summer fallowing is not recommended as a general practice for Montana. Where summer fallowing appears to be necessary, it may be done every third year instead of every second year. Do not plow summer fallow until weeds and volunteer grain have started.

Have a rough mulch instead of a dust mulch. Keep the weeds down by cultivating when they are small. Use a weeder that will not fine the soil too much.

Use a cultivated crop, such as corn, as a substitute for fallow. Grain seeded on disked corn ground yields nearly as well as grain on fallow.

Grow varieties adapted to your locality and conditions. Sow grain that is free from disease and weed seeds. To prevent smut, treat all grain with a formaldehyde solution before seeding.

The use of a combined harvester and thrasher is not recommended for Montana. On large areas use a header and stack the grain carefully. On small farms use a binder and stack the grain.

Winter wheat is the most important dry-land grain crop in Montana except in the eastern part of the State. The Kharkof is the best variety of winter wheat to grow.

Sow winter wheat at any time between August 10 and September 10 at the rate of 3 pecks per acre.

Durum wheat is better than spring common wheat for growing on the dry lands of Montana. The Pelissier is the highest yielding durum wheat at Moccasin.

Of the spring common wheats, the Marquis is a promising variety which is adapted to the western portion of the dry-land section.

The Sixty-Day variety of oats is the best one to grow on dry land.

The White Smyrna is the best barley to grow on the dry lands of the State. When a barley for hay or for hogging off is desired grow Nepal (White Hull-less).

The Russian (North Dakota No. 155) is the best variety of flax to grow. In the eastern part of the State some of the disease-resistant varieties may do better.

Early seeding is desirable for all spring-grain crops. Sow spring wheat, oats, and barley as early as the land can be prepared. The best date for sowing flax is between April 15 and May 1.

The best rates of seeding for the spring grain crops are as follows: Wheat, 4 pecks to the acre; oats, 4 to 5 pecks; hulled barley, 5 pecks; naked (hull-less) barley, 4 pecks; and flax, 15 to 20 pounds.

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Durum Wheat. Farmers' Bulletin 534.

Growing Hard Spring Wheat. Farmers' Bulletin 678.

Varieties of Hard Spring Wheat. Farmers' Bulletin 680.

Marquis Wheat. Farmers' Bulletin 732.

Winter Wheat in Western South Dakota. Bureau of Plant Industry Circular 79.

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